Lakes as defined in this subchapter that:

(1) Was contracted for on or after November 17, 1986, or delivered on or after November 17, 1988.

(2) Has undergone a major conversion under a contract made on or after November 17, 1986, or completed a major conversion on or after November 17, 1987.

[CGD 80–159, 51 FR 33059, Sept. 18, 1986]

§ 172.225 Calculations.

(a) Each vessel must be shown by design calculations to meet the survival conditions in § 172.245 in each condition of loading and operation, assuming the damage specified in § 172.230.

(b) When doing the calculations required by paragraph (a) of this section, the virtual increase in the vertical center of gravity due to a liquid in a space must be determined by calculating either—

(1) The free surface effect of the liquid with the vessel assumed heeled five degrees from the vertical; or

(2) The shift of the center of gravity of the liquid by the moment of transference method.

(c) In calculating the free surface effect of consumable liquids, it must be assumed that, for each type of liquid, at least one transverse pair of wing tanks or a single centerline tank has a free surface. The tank or combination of tanks selected must be those having the greatest free surface effect.

(d) When doing the calculations required by paragraph (a) of this section, the buoyancy of any superstructure directly above the side damage must not be considered. The unflooded parts of superstructures beyond the extent of damage may be considered if they are separated from the damaged space by watertight bulkheads and no progressive flooding of these intact spaces takes place.

§ 172.230 Character of damage.

(a) Design calculations must show that each vessel can survive damage—

(1) To any location between adjacent main transverse watertight bulkheads;

(2) To any location between a main transverse bulkhead and a partial transverse bulkhead in way of a side wing tank;

(3) To a main or wing tank transverse watertight bulkhead spaced closer than the longitudinal extent of collision penetration specified in Table 172.235 to another main transverse watertight bulkhead; and

(4) To a main transverse watertight bulkhead or a transverse watertight bulkhead bounding a side tank or double bottom tank if there is a step or a recess in the transverse bulkhead that is longer than 10 feet (3.05 meters) and that is located within the extent of penetration of assumed damage. The step formed by the after peak bulkhead and after peak tank top is not a step for the purpose of this paragraph.

§ 172.235 Extent of damage.

For the purpose of the calculations required in § 172.225—

(a) Design calculations must include both side and bottom damage, applied separately; and

(b) Damage must consist of the penetrations having the dimensions given in Table 172.235 except that, if the most disabling penetrations would be less than the penetrations described in this paragraph, the smaller penetration must be assumed.

TABLE 172.235—EXTENT OF DAMAGE

Collision Penetration	
Longitudinal extent	0.495 $L^{2/3}$ or 47.6 feet. (1/3 $L^{2/3}$ or 14.5 m), whichever is less.
Transverse extent	4 feet 2 inches (1.25 m).[1]
Vertical extent	From the baseline upward without limit.
Grounding Penetration Forward of a Point 0.3L Aft of the Forward Perpendicular	
Longitudinal	0.495 $L^{2/3}$ or 47.6 feet. (1/3 $L^{2/3}$ or 14.5 m), whichever is less.
Transverse	B/6 or 32.8 feet (10 m), whichever is less, but not less than 16.4 feet (5 m).[1]
Vertical extent	0.75 m from the baseline.
Grounding Penetration at Any Other Longitudinal Position	
Longitudinal extent	L/10 or 16.4 feet (5 m), whichever is less.
Transverse	4 feet 2 inches (1.25 m).

TABLE 172.235—EXTENT OF DAMAGE—Continued

Vertical extent	2 feet 6 inches (0.75 m) from the baseline.

[1] Damage applied inboard from the vessel's side at right angles to the centerline at the level of the summer load line assigned under Subchapter E of this chapter.

§ 172.240 Permeability of spaces.

When doing the calculations required in § 172.225,

(a) The permeability of a floodable space, other than a machinery or cargo space, must be assumed as listed in Table 172.240;

(b) Calculations in which a machinery space is treated as a floodable space must be based on an assumed machinery space permeability of 85% unless the use of an assumed permeability of less than 85% is justified in detail; and

(c) Calculations in which a cargo space that is completely filled is considered flooded must be based on an assumed cargo space permeability of 60% unless the use of an assumed permeability of less than 60% is justified in detail. If the cargo space is not completely filled, a cargo space permeability of 95% must be assumed unless the use of an assumed permeability of less than 95% is justified in detail.

TABLE 172.240—PERMEABILITY

Spaces and tanks	Permeability (percent)
Storeroom spaces	60
Accommodations spaces	95
Voids	95
Consumable liquid tanks	[1] 95 or 0
Other liquid tanks	[2] 95 or 0
Cargo (completely filled)	60
Cargo (empty)	95
Machinery	85

[1] Whichever results in the more disabling condition.
[2] If tanks are partially filled, the permeability must be determined from the actual density and amount of liquid carried.

§ 172.245 Survival conditions.

A vessel is presumed to survive assumed damage if it meets the following conditions in the final stage of flooding:

(a) *Final waterline*. The final waterline, in the final condition of sinkage, heel, and trim must be below the lower edge of an opening through which progressive flooding may take place, such as an air pipe, or an opening that is closed by means of a weathertight door or hatch cover. This opening does not include an opening closed by a:

(1) Watertight manhole cover;

(2) Flush scuttle;

(3) Small watertight cargo tank hatch cover that maintains the high integrity of the deck;

(4) Class 1 door in a watertight bulkhead;

(5) Remotely operated sliding watertight door;

(6) Side scuttle of the nonopening type;

(7) Retractable inflatable seal; or

(8) Guillotine door.

(b) *Heel angle*. The maximum angle of heel must not exceed 15 degrees, except that this angle may be increased to 17 degrees if no deck edge immersion occurs.

(c) *Range of stability*. Through an angle of 20 degrees beyond its position of equilibrium after flooding, a vessel must meet the following conditions:

(1) The righting arm curve must be positive.

(2) The maximum righting arm must be at least 4 inches (10 cm).

(3) Each submerged opening must be weathertight

(d) *Metacentric height*. After flooding, the metacentric height must be at least 2 inches (50 mm) when the vessel is in the equilibrium position.

(e) *Progressive flooding*. In the design calculations required by § 172.225, progressive flooding between spaces connected by pipes, ducts or tunnels must be assumed unless:

(1) Pipes within the assumed extent of damage are equipped with arrangements such as stop check valves to prevent progressive flooding to other spaces with which they connect; and,

(2) Progressive flooding through ducts or tunnels is protected against by:

(i) Retractable inflatable seals to cargo hopper gates; or

(ii) Guillotine doors in bulkheads in way of the conveyor belt.

PART 173—SPECIAL RULES PERTAINING TO VESSEL USE

Subpart A—General

Sec.